

Oakridge 2019 Targeted Airshed Program: Emission Calculations

Overview

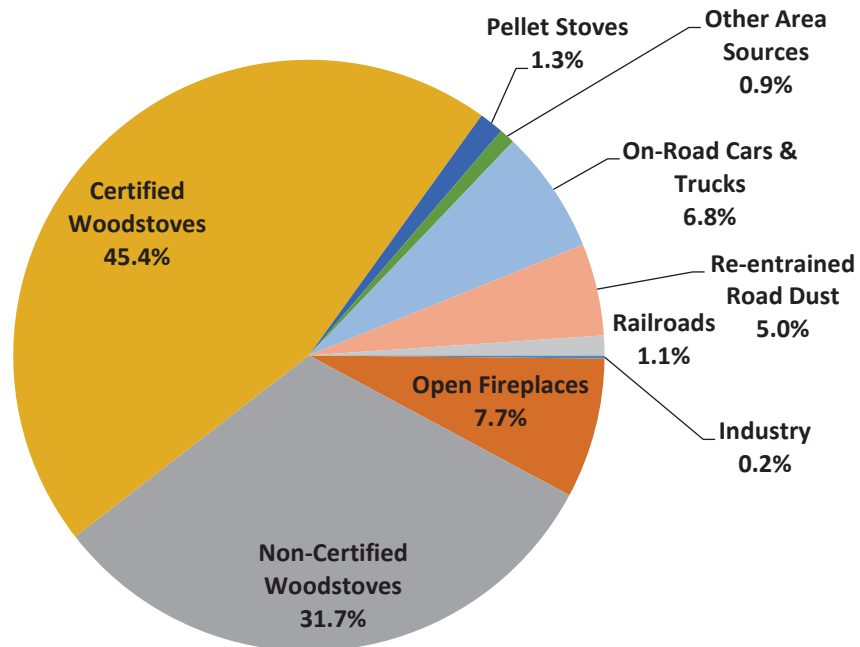
Oregon and the Lane Regional Air Protection Agency (LRAPA) have been leaders for many years in effectively reducing particulate emissions from home wood heating. To illustrate, here are two examples from the 1980s that provided the overall framework for strategies to reduce PM₁₀ and PM_{2.5} in several Oregon airsheds: [A Comprehensive Strategy to Reduce Residential Wood Burning Impacts in Small Urban Communities](#) and [Oregon's Woodstove Certification Program](#).

The PM_{2.5} emission inventories for the Oakridge area for 2008 and 2015 were included in the [Oakridge 2016 PM_{2.5} Attainment Plan](#) ("[2016 Plan](#)"). Woodsmoke contributes 75-85% of PM emissions in the Oakridge airshed. The [2016 Plan](#) was adopted by the LRAPA Board of Directors on November 10, 2016, approved and incorporated into the State Implementation Plan (SIP) by the Oregon Environmental Quality Commission (EQC) on January 18, 2017, and approved by the U.S. Environmental Protection Agency (EPA) on February 18, 2018 [[83 FR 5537](#)] effective March 12, 2018. Residential Wood Combustion (RWC) emissions from certified and non-certified woodstoves, fireplaces and pellet stoves were identified as the major source of PM_{2.5} emissions on worst winter days contributing to violation of the national air quality health standard (NAAQS) for PM_{2.5}.

Therefore, the PM_{2.5} control strategy in the [2016 Plan](#) focused on the reduction of RWC emissions; this EPA Targeted Airshed Grant also will focus on the reduction of RWC emissions. The 2008 and 2015 emission inventories are summarized in the [2016 Plan](#) on pages 19-30; details are included in [Appendix 1](#); the emission inventory methodologies are outlined in [Appendix 3-D](#). The emission inventory calculations for this EPA Targeted Airshed Grant are consistent with the methodologies in the EPA-approved [2016 Plan](#).

The modeled air quality improvements resulting from the PM_{2.5} emission reductions in this EPA Targeted Airshed Grant will be calculated according to the same methodologies coordinated with EPA Region 10 in the EPA-approved [2016 Plan](#). The modeling methods are summarized on pages 33-39 of the [2016 Plan](#), including the Positive Matrix Factorization (PMF) of speciated PM_{2.5} data, the Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbonaceous Material Balance Approach (SANDWICH) speciation formulation, and the Rollback Model. Details on PMF are included in [Appendix 3-E-2](#). Details on SANDWICH are included in [Appendix 3-E-1](#). Details on Rollback Modeling are included in [Appendix 3-H](#).

The emission reductions and air quality improvements achieved during 2008-2015 are summarized in Table 12 on page 43 of the [2016 Plan](#), including Long-Term PM_{2.5} reductions of 38 pounds per day (2.6 ug/m³) and Short-Term PM_{2.5} reductions of 107 pounds per day (7.1 ug/m³) on worst winter days. We expect the PM_{2.5} emission reductions and air quality improvements from this TAG project to be greater than the 2008-2015 progress, as outlined in Section E of the TAG application. For perspective on the importance of reducing RWC emissions, the 2008 PM_{2.5} emission inventory, before implementation of the 2008-2015 strategy, is summarized in the following pie chart.



Oakridge PM_{2.5} Emission Inventory for 2008 Worst Winter Days.

Background Documents on LRAPA Website

The key rulemaking and technical support documents are posted on the LRAPA website: <http://www.lrapa.org/271/Adopted-Rules#OAKRIDGE>. To view the plan and related documents click the links below:

The Updated Oakridge-Westfir PM_{2.5} Attainment Plan

Appendices:

- [Appendix 1: Updated Emission Inventories including MOVES 2014a On-road Modeling Results.](#)
- [Appendix 2: Oakridge Air Pollution Control Ordinance #920.](#)
- [Appendix 3: 2012 Oakridge PM_{2.5} Attainment Plan and Appendices.](#)
- [Appendix 4: Transportation Conformity Motor Vehicle Emission Budgets.](#)

[Oakridge Update for EQC Meeting in January 2017 with photos](#)

[Staff Report for Updated Oakridge-Westfir PM Attainment Plan LRAPA Final](#)

Preliminary Calculations for TAG Project

All of the documents referred to in this section are posted on the LRAPA Rulemaking page in the previous section. The summary table of results of the 2008-2015 work is Table 12 on page 43 of the [2016 Plan](#):

RWC Strategy Category	Reductions on Worst Winter Days		Time	Emission	Oakridge	Ordinance
	lb/day	ug/m3	Period	Inventory	Ordinance	Date
Long-Term RWC Strategies	38	2.6	2009-2014	2015	#903	Oct-2012
Short-Term Curtailment	107	7.1	2009-2014	2015	#903	Oct-2012
Supplemental Underway	25	1.7	2015	2016	#914	Oct-2015
Conditional Contingency	42	2.8	Future	Future	#920	Oct-2016

The emission inventory calculations in this section are based on Tables 1, 1a, 2, 2a, and 5 of [Appendix 1](#). The more detailed emission information is taken from tables on pages 93-106 of [Appendix 3-D-2](#): Table 3a (PM2.5), Table 5 (NOx), Table 7 (SO2), Table 9 (VOC), and Table 11 (NH3). The annual base emissions of a conventional (non-certified) woodstove in Oakridge is 91.8 pounds PM2.5, 8.4 pounds NOx, 1.2 pounds SO2, 159.0 pounds VOC, and 5.1 pounds NH3.

On the 145 targeted Oakridge woodburning households in the TAG project, the weatherization is expected to reduce space heating energy use by 25-28% (based on recent results by Homes For Good, formerly HACSA), and the heat pump combined with certified woodstove is expected to reduce woodburning emissions by 80-100% depending on the reliance (50-100%) on the heat pump for home heating. The combined emission reduction is 85-100%, and for subsequent calculations we used the mid-range of 92%. Performance and efficiency calculations will be confirmed based on actual work and appliance decisions during the implementation of the TAG project.

Thus the expected permanent annual emission reductions from the work on the 145 households are calculated to be 12,246 pounds PM2.5, 1,120 pounds NOx, 160 pounds SO2, 21,210 pounds VOC, and 680 pounds NH3. The expected lifetime emission reductions from the 145 households (based on 50-year life of the weatherization work and lightly-used certified woodstoves; the heat pumps may require some maintenance-replacement after 15-20 years) are calculated to be 306 tons PM2.5, 28 tons NOx, 4 tons SO2, 530 tons VOC, and 17 tons NH3. More importantly, the expected PM2.5 emission reductions from the 145 households on worst-case winter days are calculated to be 102 pounds per day on typical winter season days and 112 pounds per days on worst-case winter days. Based on the modeling in the [2016 Plan](#), the 112 pounds per day PM2.5 emission reduction on worst-case winter days is expected to permanently reduce ambient PM2.5 concentrations by 7.5 micrograms per cubic meter (µg/m3).

In addition to the permanent emission reductions above, there will also be short-term emission control programs during the 5-year project period, including firewood seasoning programs and expanded code enforcement program for curtailment and opacity compliance, and education outreach. The expanded code enforcement program is expected to increase curtailment compliance from 30% to 50%, based on experiences in other Oregon airsheds. The expected emission reductions and air quality improvements were calculated according to the same methodology as outlined on pages 37-42 of the [2016 Plan](#). The expanded code enforcement program is expected to reduce worst winter day PM2.5 emissions by 69 pounds per day and PM2.5 concentrations by 5.3 µg/m3. Performance and emission calculations, and subsequent airshed modeling results, will be confirmed during the implementation of the TAG project.

This permanent 7.5 µg/m3 reduction, combined with the expanded code enforcement coverage and other programs included in the 5-year project, are expected to reduce worst winter day PM2.5 emissions by 191 pounds per day and PM2.5 concentrations by 12.8 µg/m3. This 12.8 µg/m3 improvement is expected to reduce the 46 µg/m3 Oakridge 2015-2017 PM2.5 Design Value (in the EPA Nonattainment

Area Ranking of the 2018 Targeted Airshed Grant Program RFA) to 33.2 µg/m³, in compliance with the national ambient air quality standard of 35 µg/m³, by the end of the 5-year TAG project.

The emission calculations in this section were used to complete the following table in Section E (Environmental Results—Outcomes, Outputs and Performance Measures) of the TAG application:

EXPECTED PROJECT OUTPUTS AND OUTCOMES

Outputs	Outcomes
<ul style="list-style-type: none">- Replace all existing uncertified wood stoves. Approximately 145 remaining. <p>Replace with certified wood stoves, pellet stoves, propane heat, electric heat or others.</p> <ul style="list-style-type: none">- Install 145 Ductless Heat Pumps as alternative heat sources.- Install upgraded weatherization for 145 of homes.- Install air filters for three schools and 2,024 residences.- Sell 200 cords of dry, seasoned wood through community firewood program.- Increase code enforcement program for curtailment and opacity compliance, and education outreach.	<p>Reduced PM emissions. The expected permanent emission reductions per year are 12,246 lb. PM_{2.5}, 1,120 lb. NO_x, 160 lb. SO₂, 21,210 lb. VOC, and 680 lb. NH₃. The expected lifetime emission reductions are 306 tons PM_{2.5}, 28 tons NO_x, 4 tons SO₂, 530 tons VOC, and 17 tons NH₃, based on 50-year life (heat pumps may require some maintenance-replacement at 15-20 years).</p> <p><i>More importantly for the 24-hr standard, PM_{2.5} emissions on worst days will be reduced by 191 lb./day and PM_{2.5} concentrations will be reduced by 12.8 ug/m³, reducing the 2015-2017 Design Value of 46 ug/m³ to 33.2 ug/m³.</i></p>

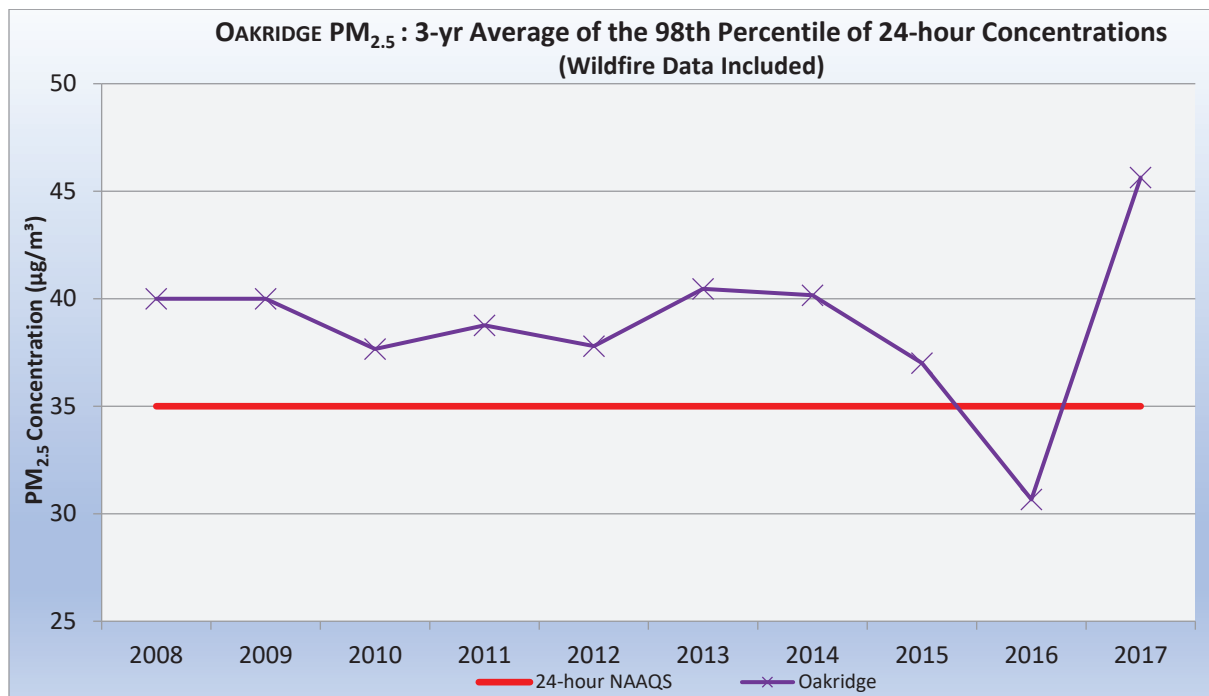
Regarding overall cost-effectiveness of the TAG project, more important than the cost per ton of emission is the cost per unit of air quality improvement and progress to meet the air quality health standard. In this case, the expected cost per unit of air quality improvement is calculated to be \$385,800 per µg/m³ PM_{2.5}, and the overall air quality improvement is expected to result in full compliance with the PM_{2.5} health standard of 35 µg/m³.

If there are any questions, or if additional documentation is needed, please contact:

Merlyn L. Hough, P.E., BCEE
Lane Regional Air Protection Agency
1010 Main Street, Springfield OR 97477

Office phone: (541) 736-1056 x216 or Cell phone: (541) 285-3063
Email: merlyn@lrpa.org

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24-HOUR AVERAGE PM _{2.5} LEVELS 2008 - 2017 (µg/m³)											
Site Name		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Oakridge	Annual mean	11.5	11.0	8.9	10.0	7.6	9.8	10.0	8.9	6.7	13.0
	Highest 24-hour	43.5	44.1	43.1	47.9	49.9	54.9	46.1	39.3	30.7	200.0
	Annual 98 th %-ile	39	41	33	42	38	41	41	29	22	86
	3 year 98 th %-ile	40	41	38	39	38	40	40	37	31	46